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NOMINATIONS—NOAA

HEARING

BEFORE THE

COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

DECEMBER 15, 1987

DR. MELVIN N. A. PETERSON, TO BE CHIEF SCIENTIST, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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DR. MELVIN N.A. PETERSON TO BE CHIEF SCIENTIST, NOAA

TUESDAY, DECEMBER 15, 1987

U.S. SENATE,
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION,
Washington, DC.

The committee met, pursuant to notice, at 10:10 a.m., in Room SR-1253, Russell Senate Office Building, Hon. Jim Exon presiding.

Staff members assigned to this hearing: Mike Nussman, professional staff member; and Macky Ayers, minority professional staff member.

OPENING STATEMENT OF SENATOR EXON

Senator EXON. The hearing will please come to order, in the absence of Chairman Hollings, who hopes to be here momentarily but has asked me to proceed with the hearing in the interest of saving time. Senator Hollings is tied up, as one would imagine, with a very important matter of the reconciliation process.

The hearing this morning is on the nomination of Dr. Melvin N.A. Peterson to be chief scientist of the National Oceanic and Atmospheric Administration. Welcome to you, Dr. Peterson.

And the chair now recognizes the Senator from California.

OPENING STATEMENT BY SENATOR WILSON

Senator WILSON. Thank you very much, Mr. Chairman. I am very grateful to you for convening the subcommittee in the absence of the chair.

Mr. Chairman, it is with great pleasure that I appear here this morning to introduce to the committee Dr. Melvin Peterson, the President's nominee to be the first incumbent in the position of chief scientist for the National Oceanic and Atmospheric Administration.

I first met Mel Peterson almost 20 years ago, shortly after he interrupted his tenure as a distinguished professor of oceanography at the Scripps Institution of Oceanography to become the chief scientist of the Deep Sea Drilling Project.

The occasion of our meeting was a symposium that had been organized in honor of this new project, and it was really in celebration of the first entry of the now famous drilling vessel, the Glomar Challenger, into the port of San Diego.

Since that time, Dr. Peterson has distinguished himself worldwide as the director of this fascinating project. It is a project that has literally probed beneath the ocean's floor.

The work done by the Scripps project has helped develop a whole new global understanding of the deep ocean that is probably matched only by the work of scientists who have been probing the depths of outer space.

Dr. Peterson has been recognized for his work on the Deep Sea Drilling Project with several significant honors and citations, including the Meritorious Public Service Award from the National Science Foundation. He is a fellow in the Geological Society of America, the author of numerous articles and a contributor to books and productions having to do with environmental science.

Dr. Peterson's experience, as well as his impressive academic credentials and his numerous publications and the respect that he commands, deservedly, from his scientific peers throughout the world, all combine to confer upon him an especially attractive quality as the nominee for the post of chief scientist.

This is an agency that has increasingly important responsibilities. I think NOAA needs an individual such as Mel Peterson to coordinate its scientific work, the research that is so important, and to bring together the very considerable resources of that agency into one cohesive and integrated whole.

Once again, let me just say that I have a particular pleasure, Mr. Chairman, in introducing a fellow San Diegoan and someone who is a friend. But more important than that, obviously, is the fact that he brings to this particular responsibility—and it is a very intriguing and a very important responsibility—remarkable preparation for it, remarkable experience, and the kind of world recognized distinction that we are fortunate to have.

Senator EXON. Senator Wilson, thank you very much and we appreciate your taking the time to come over and introduce this distinguished American to the committee this morning. And certainly as a valued member of this committee, your recommendation for Dr. Peterson will have considerable weight with myself and others.

I have been advised that Senator Hollings will be tied up and will not be able to come over soon. We will submit his statement and one I have from Senator Pressler in the record at this point.

[The statements and biographical sketch follow:]

OPENING STATEMENT BY THE CHAIRMAN

Good morning. As many of you know, I played a major role in the establishment of the National Oceanic and Atmospheric Administration in 1970. Since then, I have helped develop the agency's programs and budget through my work on this Committee and on the Appropriations Committee. My work in this area has made me quite familiar with NOAA's numerous responsibilities which are so vital to the national interest—natural resource conservation and management, weather forecasting and public warnings, aviation and marine safety, the national geodetic network, and oceanic and atmospheric research and services.

As I have worked with NOAA over the past 17 years, I have tried to ensure that the agency is provided with the best possible leadership. NOAA got off to a fine start with the selection of Dr. Robert White, a highly respected leader and scientist, as its first Administrator. In considering prospective candidates for NOAA's leadership, I have invariably sought to reach the standard set by Dr. White's appointment in 1970.

Today we will hear from Dr. Melvin Peterson, the President's nominee to be Chief Scientist of NOAA. If confirmed, Dr. Peterson will be NOAA's first Chief Scientist, as last year Congress created this post to replace the Associate Administrator's position. Dr. Peterson has been on the faculty of Scripps Institution of Oceanography at the University of California since 1960 when he completed his Ph.D. in marine geol-

ogy. In 1967, he became Chief Scientist of the Deep Sea Drilling Project, an international global program that examines the geologic history of the ocean basins. In 1971, he took over full management and direction of the project and continued in that position until his retirement from the University in June of this year.

In creating the position of Chief Scientist, Congress recognized that it was vital for someone in NOAA's upper management to have direct scientific experience relevant to the agency's work. I strongly supported this change when the legislation was first being considered. And now, as I view the challenges that face NOAA in the future—ranging from the management of our coastal areas as they come under increased population pressure to understanding phenomena such as ozone depletion and sea level rise and the impacts they will have on mankind—I can say, we need the expertise and leadership at NOAA more than ever.

Dr. Peterson's general scientific background and his experience in managing the Deep Sea Drilling Project are indeed impressive. I look forward to learning more about what he can offer NOAA in the area of scientific leadership.

Opening Statement by Senator Pressler

Thank you, Mr. Chairman, for scheduling this meeting today on the nomination of Melvin Peterson to be Chief Scientist of the National Oceanic and Atmospheric Administration. This newly created position is one which needs to be filled by a highly qualified scientist with a solid academic background. Dr. Peterson's record shows him to be eminently qualified and I wish him much luck in this challenging position.

Dr. Peterson's background in oceanography and marine geology should serve him well in performing his duties. I would hope, however, that he also develops a keen interest in atmospheric studies, as this area of scientific endeavor must not be neglected. I am confident that NOAA and the nation can only benefit from the appointment of Melvin Peterson to this position.

Again, Mr. Chairman, thank you for holding this hearing. I wish Dr. Peterson much success as Chief Scientist of the National Oceanic and Atmospheric Administration.

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United States Senate
COMMITTEE ON COMMERCE, SCIENCE, AND TRANSPORTATION
WASHINGTON, DC 20510-6125

STATEMENT FOR COMPLETION BY PRESIDENTIAL NOMINEES

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

A. BIOGRAPHICAL DATA

1. Name: PETERSON (Last) Melvin (First) Norman Adolph (Other)

Address: 1221 Umatilla Road (Current residence)
Del Mar, CA 92014

Scripps Institution of Oceanography (Emeritus Office) (Business)
University of California, San Diego
Mail Code A-031
La Jolla, CA 92093

2. Position to which nominated: Chief Scientist; National Oceanic & Atmospheric Administration

Date of nomination: 2 October 1987

3. Date of birth: May (month) 27 (day) 1929 (year)

Place of birth: Evanston, Illinois

4. Marital status: Married

Full name of Spouse: Margaret Stewart (Forbes) Peterson

5. Names and ages of children: Katrina 28; Valerie 15; John 26; Bruce 24

6. Education:

Institution	Dates attended	Degrees received	Dates of degrees
Northwestern Univ.	1947-1951	B.S.	1951
Northwestern Univ.	1954-1956	M.S.	1956
Harvard Univ.	1956-1960	Ph.D.	1960

7. Employment record/Government experience: List major military assignments and any special duties associated with State or local governments, including advisory, consultative, or honorary positions.

From	To	Name of employer	Address	Type of work
1947	1951	U.S.N.		NROTC Midshipman Disbursing Officer
1951	1954	U.S.N.	U.S.S. Tanner	Hydro Survey Group 15
			U.S.S. Daly DD 519	Supply Officer; Coding Ofcr. Qual. J.O.D.; Korean Veteran
1954	1956	Northwestern Univ.	Evanston, Ill.	Teaching Asst.
1957	1960	Harvard Univ.	Cambridge, Mass.	Teaching Asst.
1960	1987	Univ. of California	Scripps Institution of Oceanography La Jolla, CA 92093	Oceanography Marine Geology Research Teaching Asst. Dept. Chairman *Program Administration
*1967	1987	*Deep Sea Drilling Project (NSF Contract NSF-C482)		*Chief Scientist *Project Manager *Co-Principal Investigator *Principal Investigator *Program Director

8. Memberships: List all memberships and offices held in professional, fraternal, scholarly, civic, charitable, and other organizations.

Fellow - Geological Society of America; Member - New York Academy of Sciences; Member - American Assoc. for the Advancement of Sciences; Registered Geologist - Dept. of Consumer Affairs State of California; Member (non-voting) Executive Committee of the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES): Designated Alternate Member - Joint Oceanographic Institutions, Inc. (JOI INC.): Asst. Chairman and acting Chairman - Graduate Dept. of Scripps Institution of Oceanography; Member - Sigma-Xi; Member - Sextant Honorary Naval Fraternity Northwestern Univ.; Elected Member 3 terms of office 1964-1976 and President two years - Del Mar Union Elementary School District Board of Trustees; President and Board Member - Pacific Research Foundation; former member American Assoc. of Petroleum Geologists, American Geophysical Union, Society of Economic Paleontologists and Mineralogists; Member - Harvard Alumni, Northwestern Alumni.

9. Honors and awards: List all scholarships, fellowships, honorary degrees, honorary society memberships, and any other special recognitions for outstanding service or achievement.

Member Sigma-Xi; Member Sextant Honorary Naval Fraternity Northwestern University; Visiting Lecturer Geological Society of America and American Assoc. of Petroleum Geologists.

J. Bachus Woodward Fellow - Harvard Univ. 1956.

Marine Technology Society - 1970 - Year's Most Significant Achievement Special Commendation for Deep Sea Drilling Project.

Offshore Technology Conference - 1987 - Special recognition for Deep Sea Drilling Project in Year's Outstanding Achievement Award to Scripps Institution of Oceanography.

National Science Foundation - 1987 - Meritorious Public Service Award for Staff of the Deep Sea Drilling Project at Scripps Institution of Oceanography.

"Jubilee Address" - To 50th Anniversary Pacific Science Congress and 12th Pacific Science Congress, Canberra, Australia.

H.M.S. CHALLENGER Centennial Observations in Edinburgh, Scotland and Canberra, Australia.

10. Published writings: List the titles, publishers, and dates of books, articles, reports, or other published materials you have written.

See separate listing attached.

In addition:

Overall direction of preparation of 96 volumes of "Initial Reports of the Deep Sea Drilling Project", Government Printing Office.

Responsible for 333 press releases on Deep Sea Drilling Project, under NSF Contract.

Numerous general interest presentations, interviews, participations and contributions to groups, displays, general authors and reporters, motion picture producers, etc., mostly relating to the Deep Sea Drilling Project activities and results.

Senator EXON. Dr. Peterson, I am pleased to recognize you at this time for your opening statement.

STATEMENT OF DR. MELVIN N.A. PETERSON

Dr. PETERSON. Mr. Chairman, I am pleased and honored to be nominated as Chief Scientist of the National Oceanic and Atmospheric Administration. I believe my experience and background qualify me to serve in this important position.

Mr. Chairman, much of my professional experience has been with the Deep Sea Drilling Project, a major national, international effort to drill and sample the deep ocean basins for scientific study. I joined the project in 1967 when, as a member of the teaching faculty of the Scripps Institution of Oceanography and having assisted in community planning for the project, I was selected as its Chief Scientist.

Shortly thereafter, I was selected for the broader responsibilities of overall program management. As we know, the Deep Sea Drilling Project, with its famous drilling vessel, the *Glomar Challenger*, went on to become one of the most successful and significant scientific ventures of the century and a source of pride and accomplishment not only to its management, but more significantly to the many scientists who became involved, both nationally and internationally.

My experience also includes individual research opening fields of current and vital interest, such as hydrothermal activity at the ocean ridges and rates of carbonate dissolution in the deep ocean. Just these two examples show interactions that cross the boundaries between atmosphere, ocean, and the solid earth.

I have had experience in both undergraduate and graduate teaching and in graduate department administration as an assistant and acting department chairman of the graduate department of the Scripps Institution of Oceanography. I am proud of my broad association with the field of education.

In addition to my professional duties, I have served as an elected member of our local school board for twelve years and also as its president. In fact, every direction one looks in my own family, one sees teachers in all three generations.

My education includes a bachelor's degree in geology with naval science from Northwestern University, a master's degree in geology from the same institution, and a Ph.D. in geology from Harvard University.

While yet in graduate school, I consciously decided that my opportunities to learn and contribute in geology would be beneath the sea, no doubt influenced by my naval experience, by my perception that this was the great unknown. I was right. My professional life has very much involved the maritime, including a long and rewarding experience with the maritime industry in the management of the *Glomar Challenger*.

I also have advised the Department of Commerce in matters of marine petroleum, minerals, and environmental studies.

Mr. Chairman, the position for which I am nominated is a new position in the top administration of NOAA. As such, it affords an opportunity to direct NOAA in more effective pursuit of science

and scientific goals. It affords an opportunity to develop these goals at the broadest levels of national interest.

The Chief Scientist's activities will combine direct study of the earth's surface with indirect study by remote sensing from space. It will combine the study of the earth's environment with the study of the environment of the earth.

Just as I sensed the opportunity to help make something great out of the Deep Sea Drilling Project, I feel the same opportunity and excitement for this role. I see the position reaching out to other scientific elements in the national scene to the researchers and universities and industry, as well as the academies, professional societies, and consortia.

I see the position as being active in helping identify and structure the new scientific themes that need to be addressed as a continuing process within the nation and internationally.

I see the position coordinating laterally with the other agency players and being sure that the most effective resources are brought to bear on the scientific work. I see the position reaching inward in NOAA and throughout its diverse structure to weave the scientific themes into the work of NOAA and into the continuing thinking of its fine scientists.

And finally, I see the position as recognizing the continuing importance of NOAA's own scientists, as well as its many operational people and its capabilities within the total community of scholarship, so that in a sense this continuous loop of planning is closed and the work is always kept fresh and alive by its own excitement and critical review.

Mr. Chairman, I believe I have the experience, the background, the reputation, the interest and the sensitivity required for this job. With the help and advice of many fine people and organizations, I look forward to filling this new position, which I believe will be a boon to the National Oceanic and Atmospheric Administration.

I believe NOAA to be a great agency and I am excited if confirmed to be part of it, to help coordinate and strengthen its science and improve the agency's service to the nation.

Mr. Chairman, thank you for this opportunity and I will be happy to answer any questions the committee may have.

Senator EXON. Dr. Peterson, thank you very much for your excellent and concise statement. As an individual born and raised in the center of this country, about as far from salt water as you can get, as an individual that never even saw or waded in salt water until I was 12 or 13 years old, I nevertheless have had a fascination all of my life with the field in which you are an expert.

And as a strong supporter also of our space research program, I would simply say that—with the pinch of the budget, certainly NOAA's needed research and development is not going to be able to get the money that you and others would like to see go in it, including this Senator.

But with that background, I just want to say that I think if there is a criticism, we have moved ahead more rapidly in our exploration of space than we have of the exploration of the earth, namely our seas. And what that holds for the future of mankind probably

is as important over the long pull as far as quality of life is concerned than even our necessary adventures in space.

So I think I can speak for the full committee in saying that your background and expertise in this whole area, with a special emphasis, I might add, with regard to the environment, which I think is critically important—and it seems to me that you have or at least bring with this nomination by the President a certain expertise that I am quite taken by.

Let me just ask you a few questions and then we will have some additional questions for the record by Senators who were not able to make it this morning. And I would hope that you could be timely in your reply to those questions before your nomination comes up before the full committee.

I suspect that I can predict that your nomination will be reported out to the Senate for confirmation after we have received the additional questions that are on the minds of some members of this committee.

First, let me ask you a general question to let you expand a little bit further on what your goals are. But if you are confirmed in this position, as I believe that you will be, your actions over the next twelve months and thereafter will strongly influence how the position is defined, and viewed as far as the future beyond that is concerned.

What are your plans and your goals for the next year, if you are indeed confirmed?

Dr. PETERSON. The next year is not a long time and it seems to me that, aside from the very important part of getting functionally organized in the office—it is a brand new office we are beginning to organize over there at NOAA—probably the most important thing is to get the position sort of organized and pointed in the right direction.

And by that I mean to establish the mechanism by which this position sort of leavens the whole loaf of NOAA, and let that be the way in which it particularly operates and reaches throughout the structure of NOAA.

I think it is very important that this position at the end of the first year will be an effective position, a respected position both within NOAA and externally. I would like to build the contacts with the professional societies, the academies, the university and industry communities, and begin to stimulate and elicit the great scientific themes that are going to be part of the work of the next decades.

It seems to me that for a first year activity that kind of directing and pointing at this particular position is an extremely important goal.

Then one of course has the several more or less assigned program elements that are basically part of the chief scientist office, and some of these are extremely important issues: the whole issue of global climate change, and begin to get this going and under control and look over the scope of the thinking that has been done.

There has been a fair amount of work already done in thinking within NOAA and out in the scientific community. I will look over the scope of this work and look for any gaps that I see in it, and begin to organize NOAA to basically play its role in this.

I see one possible project that I think would be extremely important, in fact two that would be extremely important to get going, probably as an inter-agency kind of activity and as an international activity.

Now, all you can do in the first year is begin to plan for these, but I am personally very interested and have a certain pride of authorship, if you will, in ways to approach the whole issue of study in the Arctic Ocean. And I see the Arctic Ocean as being an enormously important keystone in understanding the real fallout from what we perceive to be a possible change in global temperatures from the greenhouse effect, as an example that we all hear so much about today.

But it is a little difficult to map out, and it is difficult to see which way or how the Arctic Ocean really interacts in this. I think it would be a fascinating and very significant piece of information to recover the geological samples from the deep Arctic Ocean, in addition to the many other things that could be done along the same logistics situation in terms of really understanding what the implications of the Arctic Ocean were in the big global climate changes, for example, that occurred as we moved into the glacial periods.

Another very important project that we should begin to plan on would be again complementary to the global climate change. It would include a moored oceanographic station in deep water where in fact we could look at the variations in a very large mass of water, but get away from what we would call island effects, where if you are working near islands you are studying small-term perturbations that result simply from the disturbance of the island.

And by far the greatest volumes of the oceans are these large volumes that are relatively undisturbed oceanic water masses.

So I see a range of activities that will go all the way from getting going to fleshing in these special assignments—the acid precipitation assignment, the pollution, ocean pollution assignment.

I do like myself the idea of taking what are assignments in a sense, some of them of a statutory base, and expanding them conceptually so that basically the people that have sort of asked these questions as an assignment get back a better product, basically, than they perhaps would have thought of, to expand them conceptually and look at the fringes around them and see where they can interact with the bigger national needs and societal tensions or balancing acts, if you will.

Senator EXON. Dr. Peterson, we hear a great deal and many of us are concerned about the "greenhouse" effect. For my own information, I would like to ask you how many indicators are there that we have had climatic changes in the earth previously?

You yourself referred to the glacial age. I am curious to know, what do you scientists feel was the reason for the end of the glacier age? At least as a layman, I would presume that there had to be a warming of the earth at that time to change that glacial age.

And what scientific proof do we have that there have not been, for reasons maybe that we do not understand, climatic changes with regard to the earth, that the glacial age is only one?

I assume that there is evidence that there were other changes in the temperatures of the earth. Is that accurate?

Dr. PETERSON. Yes, there certainly have been changes in the temperature of the earth, or at least in its gradients of temperature. The past 60 million years has seen a gradual cooling of the earth, and we did indeed finally go into the glacial age in the northern hemisphere.

But there is also a southern hemisphere and it was in a glacial period considerably before that. That is indeed coming directly out of the work of the Deep Sea Drilling Project, and of course its supporting geophysical work throughout a large community.

But the general picture that has emerged is over the past 200 million years, which is basically the age of the ocean basin floor as we can see them today. They have been totally replaced for all the older periods by the sea floor spreading process. But in that sea floor spreading, continental drift process, which basically broke up what was a single large unified continent about 200 million years ago.

These continental fragments have drifted around. The entire Atlantic has opened over the sort of last 180 million years. During that movement of these continental masses, what has happened is that the geometry of circulation of the earth, the geometric configuration of the continents, have changed.

As an example, Antarctica assumed a polar position and began to develop its ice caps down there. And this is something like 40 million years ago, instead of just several million years ago, as in the case of the northern hemisphere and its glacial periods.

Of course, these glacial periods then influence sea level, too, because you are piling up water on land. And we can see, of course, the continental shelves, where commonly in the past the oceans basically have been considerably shallower and have carved off this continental shelf.

As far as the development of the temperature changes, then, what one sees is a change of the oceanic circulation in terms of carrying the heat from the equators in different ways and distributing it differently around the globe.

So scientists have many indicators. We have ways of studying the sediments in terms of their isotope contents. We can look at the evidence of former glaciers. There were glacial periods in the past, and there are a fairly large number of temperature indicators.

Senator EXON. With respect to your considerable experience with the Deep Sea Drilling Project, what is your view as to the environmental hazard in regard to future and expanded oil drilling offshore?

Dr. PETERSON. In general, I have had a long experience with our oil drilling industry, and I have developed a very sincere and profound respect for the technical capability of our oil industry.

It is unfortunate that there has been one significant oil spill in U.S. waters, but only one in my memory, and that is 20 years ago now.

Senator EXON. Was that the one in California?

Dr. PETERSON. That is correct, sir, the Union Oil spill.

There certainly is risk attendant to transportation of oil offshore. In general, my feeling is that with care the operation can be done. They have tackled some enormously difficult areas, like in the

North Sea, and the technology that has been developed has really been a challenge, and I think our oil drilling industry, frankly, has met that challenge remarkably well.

Now, of course we have to be careful, and we have to be careful not to drill where it is manifestly unsafe to drill.

Senator EXON. Have there been any serious accidents or spills in the North Sea development at all?

Dr. PETERSON. I do not believe so. I do not remember having heard of or read of serious spills in the North Sea. There have been serious accidents that have injured and lost people.

Senator EXON. But not spills. I suspect that, as serious a potential problem as this is, we probably spill an awful lot more oil into the seas accidentally than all of the oil accidents from drilling, despite the public attention that has focused on them, right?

Dr. PETERSON. Yes. Transportation is a big one, urban runoff is a big one. Yes, there have been studies made on this. I think it is at least an order of magnitude.

Senator EXON. I am pleased to recognize Senator Danforth at this time.

Senator DANFORTH. Dr. Peterson, your job is one that I would guess is undertaken with a staff of people and equipment that is way beyond my ken. Do you believe that you are adequately set up to do the job that you think should be done in your position?

Dr. PETERSON. We are not adequately set up to do the job, because we are just organizing the operation.

Senator DANFORTH. This is a new spot, is it?

Dr. PETERSON. This is a new position, a brand new position, and people are just pulling together the basic staff. There will be an assembling of these very special assignment tasks that are already going on within NOAA that will be basically part of the office operation.

We will not be operating major pieces of equipment directly out of that office, but we will be influencing the operation of major pieces of equipment—the fleet, the satellite situation, all of that, and the Weather Service and all of its modernization, with its radars and the big computers that are being worked in the whole role.

I forgot to mention that as a very important objective of the next year is in fact to get a handle on this whole issue of information handling and storage and archiving and accessing and processing.

Senator DANFORTH. Tell us how your job will affect policymaking?

Dr. PETERSON. I hope it can have a very serious influence on policymaking by providing the best available information and doing research that will in fact improve the best available information.

Senator DANFORTH. What sorts of policies would be affected? What kinds of things that go on in the government could be affected by your office?

Dr. PETERSON. Well, I certainly am attracted to directing some of the work to address aggressive new approaches to some of the enormous problems of society, the great tensions, look at them: spending your environment against maintaining productivity and competitiveness and consumption patterns.

We can do the work, I believe, with some creative thinking and lcoking for some pass plays, if you will. We are always in these defensive environmental studies, and so on, on the wrong side of the 50 yard line all of the time. You know, would it not be nice to have a pass play that could help out and begin to improve and reconstruct things instead?

We certainly have to study the grand issue, let us say, of what are you going to do with garbage? I know it is not a romantic subject, and probably some of my more academic friends are rolling with laughter if I bring that up. But as a societal problem, it is hard to find a more important one.

We certainly have to look at the issue of its disposal, and keep in mind the environment of the oceans and let us say the environment of the fresh water. You just must solve that problem in some more satisfactory way than we are doing today.

These are the kinds of issues in which we can do research that will help. Would it not be fun to go across to the other end of the hall, for instance, in this issue I just brought up on the garbage disposal, for instance, after having pulled together the options and costs and benefits and estimated them and created a few more good ideas, and then go across the other end of the building, with the real Department of Commerce, and get with them and perhaps look for a decisionmaking network of some sort where you might even posture the nation as the enterprise, if you will, in this particular venture and see basically how you can contribute to this whole tension nationally of ours, as I mentioned earlier, the productivity and competitiveness and consumption versus spending on the environment.

Or posture the globe, you see, as the enterprise, if you will, and then face outward into this evolving world economy, but with this knowledge that we have to have.

Senator DANFORTH. And you are setting this up? You are the first person to do this?

Dr. PETERSON. Yes, sir. It is the first position. We are not going to solve these problems in the first year, but I would like to see the office address these kinds of problems.

Senator DANFORTH. Are you satisfied that the office is off to a good start?

Dr. PETERSON. We have only two people tied into it right now, although we have others that are part of these assigned functions that are associated with the office as it develops, but are not part of that office yet.

Senator DANFORTH. Thank you very much.

Senator EXON. Thank you, Senator.

Dr. Peterson, another general question, but in exploring your philosophy and what your goals are a little bit. Based on the perspective of almost three decades of active involvement in the scientific community which your background and dossier shows, what is the caliber of the science that is currently being conducted at NOAA?

And do you have any suggestions specifically for improving the quality of NOAA's science and research?

Dr. PETERSON. NOAA of course has good capability and it does a fair amount of service work aimed at the prediction of hazard mitigation, prediction and sort of service work.

They also do science. I think that it is a reasonable observation to say that the amount of science that has come out of the activities of NOAA has suffered somewhat. I think that it is a fair statement to say that the work, because it is in a somewhat restricted field, in a sense, does not quite come up to the standards of the full peer reviewed science that, let us say, is done out of the National Science Foundation.

I think that this position can do much to help that and to help the scientists at NOAA really behave more like scientists, get out and be part of that community of scholarship, to try with the national and international scene of scientists, to identify the great national themes and the great international themes of research.

And I can give examples and show how they can be threaded right back into the work of NOAA, again to keep the scientific fires burning, if you will. And I think that a position like this has a very powerful possibility of doing just that, sir.

Senator EXON. What is your evaluation of the success around the world, particularly in the United States—with regard to our efforts to clean up our rivers that are dumping into the seas?

They have improved, as I understand it, considerably since that period of time, when our rivers could be maybe best described as a sewer dumping into the oceans. Has there been significant progress made in that area?

Dr. PETERSON. I think the answer is yes, there has been significant progress since the worst of the circumstances, before people realized what was happening to certain of the toxic substances.

My own experience from childhood to the present time would tend to indicate that. We have a long way to go to get back to the days of when the Magna Carta was written. There is a term in the Magna Carta that prohibits putting fishing weirs on the Thames because it would stop the salmon.

Senator EXON. Another personal note. The first individual that I ever knew personally that was involved in your rather specific scientific field was Dr. Jim Zumberg, who was at the University of Nebraska, and after that in Texas.

Do you happen to know Dr. Zumberg?

Dr. PETERSON. Yes, sir.

Senator EXON. Where is Dr. Zumberg now?

Dr. PETERSON. He is president of USC, the president of the University of Southern California. And he is also on the Arctic Commission.

Senator EXON. The next time you see him, give him my personal regards.

Let us go back to the subject at hand. There has been some discussion over the years with possibly evolving into some kind of a safe process where the sea or certain parts of the seas could be used as a nuclear waste storage area. What are your comments on that and do you think that something of this nature could eventually be feasible and environmentally safe, as opposed to land sites?

This whole nuclear waste problem is one that I think we have ignored for far, far, too long and we are going to have to do some-

thing about it. And I am just wondering about what background or experience you have had in this area and what is your attitude with regard to the possibility of using certain parts of the seas for such environmentally safe storage areas.

Dr. PETERSON. I am somewhat familiar with the work that has been done and I am very familiar with the people who have been doing some of the work. So I can easily get into the more official and professional views on the subject.

I know one of my own students was involved in this, at least at the director level at an institution. I get a little disturbed when I hear the term "nuclear wastes" always lumped together. My own feeling is that you are not going to find easy natural solutions to nuclear disposal if we do not talk about the elements themselves as individuals and think of the chemistry of the elements and their daughters during the decay series that is involved.

There was a fair amount of work done to think of, let us say, injecting or inserting encapsulated nuclear waste in the deep sea, with the thought of natural minerals serving as backup capacity to absorbing these nuclides if they were to escape for some reason, if a cannister rotted out or rusted out or was crushed or whatever.

There was work done to evaluate the amount of thermal convection that might come from the heat load produced by the decaying elements.

I am hesitant, frankly, to express an opinion right here. I have not reviewed that subject, where it stands today, and I am afraid that saying anything right now would be a bit of a shot from the hip, and they are normally worth about as much effort as went into them.

Senator EXON. I think I just have one last question of you, doctor. And I want to say that this has been a fascinating discussion this morning as far as this layman is concerned, and I think we have such a wonderful new field open to us out there.

And I guess that we maybe should be self-critical of ourselves for not progressing rapidly on such research in years past. Could you give us any general sketch on what benefits could accrue to mankind?

I mean, these are the things that we are always asked, those of us who appropriate and spend the money. What benefit is this to us, mankind? And I am thinking of such things, are there—number one, what is your opinion on certain potentially endangered species?

I mean, we certainly know the situation with regard to the whales. We certainly know the slaughtering of the seals has been a major, major concern in many areas. Those are the first two that come to mind in this area.

I suspect that whales and seals are potentially endangered, endangered more as a result of the wanton drive of mankind to make money and produce food. Number one, what do you think we should be doing in that area legislative wise or enforcement wise?

And secondly, are there potential new sources of food, sea life, that we have not tapped as yet with our traditional fishing and harvesting of food from the sea?

Dr. PETERSON. Well, going back to the most general part of your question first, what benefits can accrue to mankind? I think I have

tried to address some of those already in trying to address some of the great balancing acts that we have in our total society.

Senator EXON. I am speaking for the masses of the United States that might not be so much interested in some of the scientific environmental things, but I am asking what benefits?

For example, can we produce more salmon? Are there deep sea fish that we have never tapped as a source of food? Things of that nature.

Dr. PETERSON. I am not aware of any deep sea fish that would be suitable as a source of food. There are some awfully strange animals that live down in these hydrothermal vents at the bottom of the ocean. I suspect that they are toxic.

Senator EXON. They are pretty bony, I suppose.

Dr. PETERSON. There are bright, terrible looking colors in them, even purples and reds.

But salmon, I think that would be an attractive thing to work on. I like salmon myself, and I was in fact talking to some of my friends on just the possibility even of introducing salmon where they used to be. But the rivers are not there any more. It is not that the rivers are polluted, they are just not there, as an example, off southern California.

But it would be possible, I believe, and not beyond reason to think of trying it probably as a commercial venture. Some thinking could go into, let us say, having a salmon river basically built in an area where in fact you could go all the way from the egg stage through the frye and the smolting.

And there has been some nice work done on the smolting and the shifting of the salmon to the condition where it has to go into salt water and timing. It is a very wierd thing, where it apparently has to be related to the phase of the moon, of all things.

This is not my field, but in inquiring and discussing the possibility of introducing salmon from basically offshore platforms, the general thought is that you could do that kind of thing, as an example, with basically a raceway, artificial river that would only be hundreds of meters long.

Senator EXON. With regard to salmon, in my limited salmon fishing experience—and I have had considerable experience in fishing—the only salmon that I have caught or heard about on the East Coast is the elusive Atlantic salmon, of which there are not an awful lot any more.

Was there a time in the past when salmon were as prevalent on the East Coast of the United States as we generally think of them as being on the West Coast and of course in Alaska? Or is that just the way God set things up?

Dr. PETERSON. I cannot answer that question. I have good people at NOAA who I am sure could. I do know from my own knowledge—this is not my field—that the Great Lakes, of course, had steelhead trout in them that all got wiped out by the lampreys. And it went through a big cycle of chemical pollution and things are beginning to come back by the introduction of fish and the destruction of the lamprey, a big program throughout that area.

I honestly do not know the answer to the question on the East Coast of the United States, but my suspicion is, yes, that there were salmon there.

Senator EXON. Well, we have a lot of concerns today with regards to pollution in our shellfish and the shellfish industry is under considerable stress and strain. I suppose by and large that is as a result of manmade pollution.

Well, I am pleased to see that you are concerned and have some possible things that we might do with regards to promotion of such things as salmon and other fish and wildlife, which certainly, as you well know, is a very, very important part of our environment.

Dr. Peterson, I thank you for coming here and I appreciate your forthcoming attitude. You have made a very favorable impression on the committee, and in due course and after you answer any questions that are submitted to you by mail, I am confident that the chairman will call a meeting of the committee and ask for a favorable report of your nomination to the floor of the United States Senate.

Dr. PETERSON. Thank you very much, Mr. Chairman. I will be pleased to answer any questions. I recommend that they be sent to the Department of Commerce so that they do not get lost in the mail.

Senator EXON. Thank you very much, Dr. Peterson. And with that, Merry Christmas and we are adjourned.

[Whereupon, at 10:55 a.m., the committee was adjourned.]

[The following information was subsequently received for the record:]

POSTHEARING QUESTIONS OF THE CHAIRMAN AND THE ANSWERS

Question 1. As NOAA's first Chief Scientist, your actions over the next 12 months will strongly influence how the position is defined and viewed in the future.

What are your plans and goals if you are confirmed?

Answer. Since the Office of the Chief Scientist is a new position, my top priority, if confirmed, will be to establish and organize the office to ensure NOAA's scientific research is coordinated within the agency; among other Federal agencies; with the community, including international interests, and professional organizations; and, with the academic institutions which have an interest in NOAA's mission. Fostering a unified approach to NOAA's science will be a critical function of the office. This unification can be encouraged by idenifying common themes and long-term planning and needs. Where necessary, organizational mechanisms will be established to accomplish the goal of unified, well-planned and coordinated NOAA research.

In order to encourage a unified NOAA science program, data management will be one of my top priorities, if confirmed. The management will be one of my top priorities, if confirmed. The storage, access and preservation of data for the benefit of all NOAA users as well as the community at large is a critical need of the agency. In my pre-hearing questions, I addressed other opportunities which could be started if I am confirmed for the position of Chief Scientist.

Question 2. What would you identify as the most important scientific challenge to face NOAA in the upcoming months? Over the next decade?

Answer. In the short-term, I plan, if confirmed, to begin unifying NOAA's science into a comprehensive whole rather than programs within specific line offices. The opportunity to begin this task might be the global climate initiative, since it will require us to build on our continually evolving understanding of the air/sea interactions and improve our predictive capabilities. This initiative can, and will, involve all of NOAA's line offices. Once this initiative is well-established as an agency scientific theme, it can guide other related programs which NOAA might pursue into the long-term, for example, a large marine ecosystem approach to some of our wet science programs. I fully expect this initiative to guide NOAA's science during the next ten years.

Question 3. Based on the perspective of almost 3 decades of active involvement in the scientific community, what is the caliber of science that is currently being conducted at NOAA?

Do you have any suggestions for improving the quality of NOAA science?

Answer. I think the caliber of science currently being conducted at NOAA is sound, and in many instances, outstanding. In the past, I am aware that some within the community have been critical of NOAA's science. Currently, I think most would agree that NOAA's science is good. NOAA's science has been focussed more than in the past, and the creation of an Office of Chief Scientist should help sharpen this focus. My intention, if I am confirmed, to identify certain unifying themes for agency research and to plan improved data management and more emphasis on broadening the base of our efforts through interagency and international joint efforts, could serve to improve the quality of NOAA's science.

In making this quick evaluation, I am mindful that much of NOAA's effort goes into service and predictions. It is my hope that we can continue to improve the science and our understanding and, by doing so, improve the coordination and availability of our services and predictions.

Question 4. I am well aware of the current Administration's opposition to the Sea Grant Program. Leaving that opposition aside for the moment, S. 1196, my bill reauthorizing the Sea Grant Program, would initiate a "Strategic Research Program". The purpose of that initiative is to focus the efforts of the Sea Grant network on national research priorities.

What is your view of the Strategic Program and what role do you see for the Chief Scientists in its administration?

Answer. Assuming legislation is passed by Congress and signed by the President reauthorizing the Sea Grant Program with the Strategic Research Program initiative, I think this is the kind of program which could enhance NOAA's over-all science mission. If the Strategic Research Program is authorized, it could provide the Sea Grant program with a national focus which is needed. One of the Administration's criticisms of the Sea Grant program has been that it funded research of a local or regional nature and thus support should be picked up by those local or regional interests benefitting from it. The Strategic Research Program could provide the kind of national research which would prove beneficial to everyone, while still providing the understanding needed to solve local and regional problems.

Although the Office of the Chief Scientist will not have any direct involvement in the operation of the Sea Grant Program, coordination of the science toward certain goals could be expected. Some of the agency science could be supplemented and enhanced by Sea Grant research, and certainly the Strategic Research Program could be extremely valuable in terms of coordinating NOAA science objectives with those identified by the academic community. The Program could serve to strengthen our relationships with the academic community and help broaden the base of our national, and even international, research efforts.

Question 5. Concern has grown in recent years regarding the effect of human activities on the global environment. Responding to that concern, the International Geosphere-Biosphere Program (IGBP) has been proposed as a long-term research plan which would begin in the 1990's and continue into the next century. A U.S.Global Change Program has been suggested to provide our national contribution to such an international effort.

What do you see as NOAA's role in this effort?

Can such long-term research programs provide the timely scientific information needed to develop sound policy and avert an environmental crisis?

Do you have any suggestions for improving the integration of new scientific information into that policy-making process?

Answer. NOAA's role in the U.S. Global Change Program will be principally the monitoring and prediction of global climate change. Through its administration of the National Climate Program and many atmospheric and oceanic research programs, NOAA has a unique ability to study the earth's climate system. NOAA's planned global change program recognizes that the key to understanding the climate system is to study the interactions among the earth's atmosphere, surface, and oceans. NOAA already monitors atmospheric and oceanic conditions and processes, and will continue developing integrated models to provide projections of climate change which will aid in prediction of environmental consequences and development of appropriate policy.

As far as the timeliness of long-term research programs and the integration of scientific information into the policy-making process, I wish to stress that global change is a long-term problem and must be treated as such in planning research.

Although the time lag between human activities and their environmental consequences makes some policymakers unwilling to withhold policy decisions until our understanding of global change improves, we can not develop scientific understanding overnight. We need time to develop an adequate data base and predictive models, and we must pursue this over the long-term. I believe that international

and interagency mechanisms, as well as Congressional reporting requirements, will ensure that policymakers have current scientific information.

Question 6. In recent years, despite shrinking budgets, the agency has been faced with dramatic increases in the costs associated with procuring needed hardware such as environmental satellites and modern Weather Service equipment.

Do you feel that the current fiscal constatints threaten NOAA's integrity as a science agency? Please explain.

Answer. I would like to see NOAA's scientific image and productivity improved. I see the Chief Scientist's role as important in stimulating this, and in overcoming the difficulties mentioned.

I also feel that environmental knowledge and concerns deserve increasing attention, and would hope that good plans for good ideas and programs will receive the financial respect they deserve, within available resources.

I hope, if confirmed, to direct the energies and resources of NOAA toward a healthy, scientifically exciting program that fits well with the other science in the nation and internationally, and that tends the health of the country, its science, its safety, its environment. And, as we show progress to do these things well, NOAA will prosper as it should, with the nation.

Question 7. Your response to my written question concerning estuarine programs indicates that your primary focus would be on increasing scientific understanding of the ocean's margins. Such understanding, of course, is important. However, I am concerned that you fail to identify a major concern in developing responsive estuarine and coastal programs—namely, the enormous increase in populations in these areas.

How do you view the relationship between NOAA's activities as a science agency and NOAA's responsibility to provide wise management of our nation's marine and coastal resources?

Answer. I believe I may have come close to responding to this issue in my oral testimony at my confirmation hearing.

I suggested directing some of NOAA's work toward addresssing aggressive new approaches to some of the enormous problems of society. I called for work and creative thinking that I called pass plays, to get beyond the continually defensive environmental studies and across the 50 yard line, so to speak, to begin to improve and reconstruct. I referred to garbage and sewerage as a societal problem of great importance. I suggested study for an appropriate solution that would consider both the health of the coastal oceans and our fresh water supplies. I also suggested broader involvement of the Department and that I would like to see the Office of the Chief Scientist engage in these kinds of problems.

The issue you raise, concerning population growth and distribution in the coastal zone is central and, of course, the origin of my concerns as expressed above and in my testimony.

Question 8. Your experience with the Deep Sea Drilling Project should provide you with a strong perspective on international scientific endeavors. NOAA currently participates in several international programs including TOGA (Tropical Ocean and Global Amosphere Program), WOCE (World Ocean Circulation Experiment), and the WCRP (World Climate Research Program).

What changes would you implement at NOAA in terms of setting up international research efforts, conducting business, advisory apparatus, national and international organizations, and Federal coordination?

What types of international involvement are most important, e.g., financial support, facilities, participation in the global observation network?

Answer. I am aware that the Office of Oceanic and Atmospheric Research is currently compiling and updating a complete list of the many ongoing international activities carried out through various agreements. I look forward to reviewing this document in order to understand more fully the scope and style of all NOAA's current international activities and commitments.

The Deep Sea Drilling Project (DSDP) did, indeed, give me substantial experience in international organization and operations. Through the project, we were able to develop a very workable arrangement, in addition to a respected forum for scientific planning. I look with favor on this style of flexible international arrangement and its possible use for NOAA programs in the future: each program could have its own set of players, issues and sensitivities, so no single blueprint can easily exist. Flexibility can help keep an international venture vital and productive.

All of these are important, including others such as access, data sharing, etc. I do like, for the appropriate kinds of work, e.g., major environmental studies of virtually global extent, working within the bigger economic base afforded by joint partici-

pation with pooled cost sharing, as in DSDP, but also including cooperative and coordinated use of facilities.

POSTHEARING QUESTIONS OF SENATOR KERRY AND THE ANSWERS

Question 1. I see from your resume that you have a very fine and distinguished career in the field of geological oceanography. What elements of your experience do you feel prepare you to offer policy and technological guidance to NOAA in the wide array of scientific disciplines they encompass; particularly the biological and atmospheric sciences?

Answer. My experience in a broadly-based oceanographic institution with a diverse range of interests will fit well with NOAA's range of research activities in the oceanic and atmospheric disciplines. The discipline in which I have spent my life's work, geology, encompasses some significant elements in biology and climiatology, particularly in longer time scales. This experience will be useful as Chief Scientist since NOAA's mission encompasses a wide range of oceanic and atmospheric data collection which are applied in both the short and long term to make predictions. I have had a leadership role in a major scientific project, the Deep Sea Drilling Project (DSDP), which involved significant human and financial resources and spanned a broad range of research applications. In effect, DSDP was a microcosm of NOAA in its breadth of managerial, operational and scientific challenges. I think I can identify talented scientists and provide the over-all direction to NOAA's research activities as I did as head of the Deep Sea Drilling Project.

Question 2. The effect of human activity on the global environment continues to be a pressing domestic and international issue. NOAA has a major responsibility and commitment to a 10–15 year comprehensive research program in conjunction with NASA and NSF> The Administration has proposed global research initiatives for NASA ($25.0 million) and NSF ($24.6 million) but none for NOAA. If Congress does not provide the initiative for NOAA, what will be your advice to the Undersecretary for Oceans and Atmospheres regarding NOAA's role and science policy toward Global Climate Research?

Answer. NOAA has been in the forefront of research into several global climate research activities for several years. If Congress does not provide funding for NOAA in FY 88 for Global Climate Change research, NOAA will continue to conduct research which is part of the agency's mission. It is my understanding that the hallmark of research done at NSF is understanding processes and phenomena; NASA seeks new applications for space technology. NOAA is responsible for oceanic and atmospheric prediction on all time and space scales. Basic understanding is essential to NOAA's mission; however, it is a means to an end, rather than an end in itself. NOAA's data collection and prediction activities will continue.

The agency has scored important contributions to the body of knowledge about the EL Nino effect and its impact on the world's climate through the Tropical Ocean Global Atmosphere (TOGA) program; our radiatively important trace gas (RITS) program has made significant discoveries about the effect of these gases on the ozone layer and the warming of the atmosphere. We work closely with NSF and NASA on joint climate research missions and we will continue to do so in the future. As Chief Scientist, I hope to play a role in assisting NOAA in managing data more effectively and thus sharpening the focus of their use for prediction. I also plan to recommend NOAA's serious attention to and consideration of related programs in the Arctic and in long-term time series acquisition in open oceans; both could move forward at a project level, in an interagency and international mode.

Question 3. Last week 71 of my colleagues joined me in a letter to General Secretary Mikhail Gorbachev of the Soviet Union. The letter calls for a high-level, bilateral task force on international. environmental concerns to later be addressed at a summit. I am interested in your approach to formulating such an effort and the priorities you see in both the science and technology areas. There are serious environmental issues of immediate concern: radiation releases in our air; acid deposition in our rivers, lakes, streams and estuaries; plastic and chemical pollution along our coasts and in our oceans; deterioration of our Ozone Layer; and the loss of tropical forests worldwide. What would be your approach and what specific role would you recommend for NOAA to take regarding a US-Soviet relationship on these specific issues: 1. coastal, estuarine, and oceanic areas; 2. living marine resources; 3. lower and upper atmosphere; and 4. temperate and tropical forests?

Answer. Although I have not seen the letter signed by you and your colleagues, I am sure there are many areas where cooperative research would be beneficial. I have worked in the past on scientific ventures with the Soviet Union and I believe

this experience could prove useful as Chief Scientist of NOAA. In order to address fully the areas of potential cooperation you have specifically mentioned, I would have to review bilateral and multilateral research agreements already in force and determine where it might be appropriate to renew efforts. I think it is important to stress that cooperative research in the area of oceanic and atmospheric problems will only be effective if the approach is programmatically multilateral rather than simply bilateral. Nevertheless, I am sure there are several areas of interest which, working together, we will be able to identify opportunities which would be beneficial for U.S. involvement.

Question 4. The position you seek, Chief Scientist of the National Oceanic and Atmospheric Administration was created, in part, because of the recognized need to enhance NOAA's scientific capability. In the current climate of fiscal restraint, what actions do you plan to take to retain the top scientific talent in NOAA and to encourage new recruitment?

Answer. The excitement of NOAA's mission in an era when environmental science is important helps the agency to attract scientific talent. In order to keep top scientific talent, it is critical to maintain the quality of NOAA's science. Quality science attracts quality talent. In addition, I think it is important to foster access to all of NOAA's capabilities. The Chief Scientist can assist in unifying the agency's scientific effort and ensuring cross-pollination and access to research being done agency-wide and not just in one of the five major line offices. This access and a unified approach to our science can build and maintain a team spirit which assists in attracting and retaining top scientific talent.

Question 5. Massachusetts has depended upon the sea to sustain its inhabitants for hundreds of years. That dependency is as great today as it has ever been. The Bay State has a long heritage of fishing, and I for one would like to see that heritage continue. But frankly, I am deeply concerned about the depletion of the resources upon which the fishing industry and citizens of Massachusetts depend. NOAA has many fine fisheries scientists working in Wood Hole, and is collecting a great deal of data directly at sea and remotely from satellites. The problem they face is the lack of support to analyze the data, particularly the remote sensing data. With the new NOAA emphasis on ecosystem approach to fisheries management, this becomes a larger problem. How do you plan to support the need for access and analysis of the fishery scientists to this data? How do you recommend the baseline data be structured to support analysis and management under the ecosystem approach?

Answer. Data management is a problem which faces not only the scientists at Woods Hole, but NOAA and the international scientific community. A major focus of my efforts during my tenure at NOAA will be how best to manage our data for the benefit of NOAA and the community in general. I would like to empanel a group from within and outside of the agency to provide advice to the agency on short- and long-term data management. Among the issues which must be addressed include data to be retained and archived; data structure, so we can identify a point in time against which the deterioration of an environmental event (or series of events) can be measured; and, an over-all framework for retention or dumping data during a 100 year time period. This may require new relationships with the private sector to take advantage of new technology and to ensure these data are widely available to the community at large. A cohesive data management policy for the agency will create an environment which will permit our scientists to structure the baseline and details of an ecosystem approach structure.

In a more general sense, I think the Chief Scientist can assist line organizations in problem-solving rather than trying to micromanage programs. Frequently our scientists must be managers as well as scientists. This requires a certain amount of firefighting which sometimes cuts into the scientists' ability to spend time on their science and to apply creative, scientific thinking to problems rather than performing certain programmatic requirements.

Posthearing Questions of the Minority and the Answers

WEATHER SERVICE

Question 1. Mother Nature often seems to be a step ahead of our ability to forecast severe weather systems and hurricanes and their attendant effects. What, if any, shortcomings exist in our understanding of severe weather systems and hurricanes and our ability to predict such weather phenomena?

What can and should be done to improve our scientific understanding of severe weather systems and hurricanes and our ability to predict their patterns and severity?

Answer. The shortcomings of our existing understanding of severe weather systems and hurricanes are not unlike those which scientists encountered because of things that cannot be seen. We have not had a system which could see some of the features of severe weather phenomena like microbursts and other small scale weather. The modernization of the National Weather Service should improve our ability to predict such weather phenomena because we will be able to "see" these phenomena, for example, the signature of a mesocyclone and microbursts with the installation of doppler radars.

Our understanding of severe weather systems and hurricanes will improve with the new systems planned for the National Weather Service. NOAA's atmospheric research has benefitted from development and use of prototypes of the new systems that should be operational in the 1990's Understanding and prediction will continue to improve as scientists gain experience with the new operational systems. I might also add that our current ability to predict patterns and severity of severe storms and hurricanes is good. Expectations of the public have increased over the years as the forecasts and warnings have improved. Loss of human life has decreased while property damage costs have increased due to severe storms and hurricanes.

Question 2. There have been a number of published reports that the U.S. lags behind Europe in global weather forecasting capabilities.

Is this true, and, if it is, do you see this as a problem for the U.S.?

What is the proper role for NOAA in global weather forecasting?

Answer. If the U.S. lags behind Europe in any forecasting capabilities, it is in the area of mid-range forecasts (3 to 5 day), but the U.S. is rapidly catching up in this area. In general, the U.S. forecasting capability remains the world's best. North America is affected by more diverse weather systems and more severe storm systems than Europe or, for that matter, any other area of the world. The key mission of the National Weather Service is to provide forecasts and warnings to protect life and property. Due to this mission and the variety of weather experienced by North America, a greater portion of our resources must be devoted to this function.

NOAA's role in global weather forecasting is multifaceted. In order to prepare a forecast for the United States, a global forecast must be done. In addition to this primary responsibility, the United States has a global interest in shipping, aviation and other global activities important to U.S. trade and national security. NOAA also plays an important geopolitical role in global forecasting; many nations rely on the data collected by NOAA for forecast preparation and warnings.

For some nations, the data provided by NOAA are the only data available for forecast and warning preparation.

GLOBAL CHANGE INITIATIVE

Question 3. The administration is in the process of formulating a strategy on a Global Change initiative, the thrust of which is to enable a better understanding of natural and man-induced changes that are occurring throughout the environment and the implications of these changes for the future.

What is the appropriate role of NOAA in such an initiative, and what additional activities and programs should NOAA initiate to contribute to this initiative?

Answer. NOAA's role in global climate change is central. NOAA has demonstrated leadership in the interagency planning process and NOAA scientists have made some of the key discoveries which have furthered our understanding of global change phenomena, for example, El Nino and the effect of certain gases on the ozone layer. Global climate change is dependent on air/sea interactions. NOAA's role in atmospheric and oceanic research and environmental data collection makes any initiative on global climate change almost meaningless without NOAA's involvement.

If confirmed as NOAA's Chief Scientist, one of my primary initiatives will be to manage and enhance NOAA's data collection and dissemination. In addition, I would like to seek ways to enhance NOAA's on-going global climate research activities through potential investigations in the Arctic and other possible areas which might yield critical information which would further our understanding of air/sea interactions on global climate.

DATA MANAGEMENT

Question 4. Recent developments in remote sensing from space have increased dramatically the amount of data available on the Earth's surface, atmosphere, and

processes. Furthermore, the amount of information will grow rapidly in the near future due to, among other things, increased demands in our weather satellites and NOAA's role in the Global Climate Change initiative.

In your opinion, how is NOAA equipped to manage this growing volume of data that it acquires—what deficiencies, if any, exist within NOAA for data management, and what can and should be done to alleviate these deficiencies?

Answer. NOAA has begun to work on ways to manage better its data. This is a big job, not just for NOAA, but for the entire domestic and international scientific community. I think NOAA is doing about as well as any other agency in its data management activities. The most important goal of NOAA's data management effort must be to build on what has been done thus far to develop a stable data management system responsive to NOAA's scientists, the scientific community at large as well as other users of these data.

If confirmed as Chief Scientist, I plan to establish a panel of those within and outside the agency to consider the proper preservation of our data and to establish guidelines on what needs to be saved, for how long and to pursue methods to ensure that our data is easily accessible and, as I have mentioned, a stable source of reference for the community.

Question 5. Due to efforts to reduce the Federal budget deficit, NOAA, like all Federal agencies, may not experience the budget growth over the next few years than they had previously anticipated.

How would you expect to balance the requirements for fiscal austerity with the natural tendency for NOAA's operational and research budgets to grow more rapidly than budget constraints might permit? What factors should be considered in achieving the proper balance between fiscal austerity and programmatic growth and maturity?

Answer. These constraints highlight the need to strengthen international scientific cooperation, foster interagency cooperation and, as Congress has recognized, to provide NOAA with a Chief Scientist.

For large scale environmental studies, I favor international programs with their larger economic base. I have had much experience in the organization and management of such programs, having run the Deep Sea Drilling Project, one of the most successful of the international programs and one which had true joint participation and cost-sharing among six developed nations. At the national level, interagency cooperation brings together the strengths and resources of several agencies to address effectively increasingly complex scientific issues. Within NOAA, the very structure of the Office of the Chief Scientist is a step in the right direction to improve the effectiveness of the agency in defining and reaching scientific goals and understanding with a minimum of duplication.

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